Claims

1. A system for protecting an electric motor (1) and its control circuit (2),

the control circuit (2) comprising a set of switches (Ch) to control the speed of the motor (1)

the system being characterized by:

comprising a control central (7) connected to the control circuit (2), the central control (7) being capable of measuring an electricity conduction time (T_c) of each of the switches (Ch) and to measure a time (T_d) passed between the beginning of the conduction of one of the switches (Ch) and the occurrence of a surge current, the surge being measured by means of a surge detector (3) which compares the value of a current (I_{no}) that flows trough the control circuit (2) to a predetermined current (I_{LIMIT}) value,

the central (7) making a comparison between the times (T_d, T_c) and being capable of determining whether the surge current results from an overload or from a short-circuit on the electric motor (1) or any of the switches (Ch).

2. A system according to claim 1, characterized in that the control central (7) indicates a condition of short-circuit of the motor (1) or on one of the switches (Ch) when the time (T_d) is shorter than the time (T_c) multiplied by a factor (k) that ranges from 0 to 1, and the central (7) indicates a condition of surge of the motor (1) when the time (T_d) is longer than the time (T_c) multiplied by the factor (k).

3. A system according to claim 2, characterized in that the factor (k) is equal to 0.5.

4. A method for protecting an electric motor (1) and its circuit (2),

the speed control of the motor (1) being carried out by means of a set of switches (Ch),

the method being characterized by comprising the steps of:

measuring an electricity conduction time (T_c) of each of the switches (Ch),

measuring a time (T_d) passed between the beginning of conduction of one of the switches (Ch) and the occurrence of a surge, and

comparing the times (T_d, T_c) and consequently determining whether the surge current results from an overload or from a short-circuit of the electric motor (1) or on any of the switches (Ch).

5. A method according to claim 4, characterized in that, in the comparison step, a condition of short-circuit of the motor (1) or on one of the switches (Ch) is indicated when the time (T_d) is shorter than the time (T_c) multiplied by a factor (k) that ranges from 0 to 1, and an overload condition of the motor (1) is indicated when the time (T_d) is longer than the time (T_c) multiplied by the factor (k).

6. A method according to claim 5, characterized in that, in the comparison step the factor (k) is equal to 0.5.

7. An electric motor (1) having phases (F),

the phases (F) being fed by a set of switches (Ch), and

the switches (Ch) being controlled by a control circuit (2) to modulate a voltage that is applied to the phases (F) to control the speed of the motor (1),

the motor (1) being characterized in that the control of the switches (Ch) is carried out by a control central (7) connected to the control circuit (2),

the control central (7) being capable of measuring the electricity conduction time (T_c) of each of the switches (Ch) and to measure the time (T_d) passed between the beginning of conduction of one of the switches (Ch) and the occurrence of a surge current,

the surge being a value of a current (I_{RS}) that flows trough the phases (F) higher than a predetermined current (I_{LIMIT}) value,

the central (7) making a comparison between the times (T_d, T_c) and being capable of determining whether the surge current results from an overload or from a short-circuit of the phases (F) of the electric motor (1) or any of the switches (Ch).

8. A motor according to claim 7, characterized in that the control central (7) indicates a condition of short-circuit of the motor (1) when the time (T_d) is shorter than the time (T_c) multiplied by a factor (k) that varies between 0 and 1, and the central (7) indicates a condition of overload of the motor (1) when the time (T_d) is longer than the time (T_c) multiplied by the factor (k).

9. A motor according to claim 8, characterized in that the factor (k) is equal to 0.5.